

2 1. A method of providing a relative motion between a microstructure and a fluid
medium, the method comprising:
4 providing a catalyst region within the microstructure;
 providing a non-catalyst region within the microstructure, the non-catalyst region
6 having an adjacent non-catalyst portion that is substantially adjacent to the catalyst
region;
8 providing a fluid medium, the fluid medium having a fluid component provides a
chemical reaction, the chemical reaction being catalyzed by the catalyst region; and
10 exposing the microstructure to the fluid medium, so that the catalyst region and
the adjacent non-catalyst portion are both exposed to the fluid medium,
12 wherein the chemical reaction induces the relative motion between the fluid
medium and the microstructure.

2 2. The method of claim 1, wherein the chemical reaction induces a flow of the
fluid medium from the catalyst region to the adjacent portion of the non-catalyst region

3. The method of claim 1, wherein the fluid medium is an aqueous solution.

4. The method of claim 1, wherein the fluid component is hydrogen peroxide.

5. The method of claim 1, wherein the catalyst region contains a transition metal.

2 6. The method of claim 1, wherein the catalyst region contains palladium or
platinum.

2 7. The method of claim 1, wherein the chemical reaction is an oxidation or
reduction of the fluid component.

2 8. The method of claim 1, wherein the chemical reaction is a decomposition of the fluid component.

2 9. The method of claim 1, wherein the relative motion is use to induce an autonomous motion of the microstructure through the fluid medium, the autonomous motion being powered by the chemical reaction.

2 10. The method of claim 1, wherein the relative motion is used to induce flow of the fluid medium along a fluid pathway at least partially defined by the microstructure.

2 11. The method of claim 1, wherein the direction of relative motion is controlled by modifying a surface wetting properties of the adjacent non-catalyst portion.

2 12. The method of claim 1, further including the provision of an analyte binding agent on the adjacent non-catalyst region, the relative motion being modified by the binding of an analyte within the fluid medium to the analyte binding agent.

2 13. The method of claim 11, wherein the relative motion provides a measurable force at a force sensor, the force sensor being used to detect a presence of the analyte.

2 14. The method of claim 1, wherein the relative motion is used to induce a rotation of the microstructure.

2 15. A microgear, the microgear providing autonomous rotational motion about a rotation center when the microgear is located in a fluid medium, the microgear comprising:
4 a central portion, the central portion including the rotation center; and
at least one gear tooth protruding from the central portion,

6 wherein the gear tooth includes a catalyst region and a non-catalyst region, the rotational
motion being induced by a chemical reaction of a component of the fluid medium, the
8 chemical reaction being catalyzed by the catalyst region.

16. The microgear of claim 15, wherein the catalyst region has an catalyst
2 interface with the non-catalyst region, wherein the catalyst interface has a catalyst
interface portion extending substantially radially from the central portion,
4 the chemical reaction inducing a flow of the fluid medium over the catalyst interface
portion, the flow of the fluid medium providing the rotational motion.

17. The microgear of claim 15, wherein the central portion is substantially disk
2 shaped.

18. The microgear of claim 15, wherein the microgear has a plurality of gear
2 teeth.

19. The microgear of claim B4, wherein each gear tooth includes a catalyst region
2 and a non-catalyst region, the rotational motion being powered by a chemical reaction of
a component of the fluid medium, the chemical reaction being catalyzed by the catalyst
4 region of each gear tooth.

20. The microgear of claim 15, wherein the catalyst region includes a transition
2 metal

21. The microgear of claim 15, wherein the catalyst region includes platinum or
2 palladium.

22. The microgear of claim 15, wherein the catalyst region includes an enzyme.

23. A method of providing a relative motion between a microstructure and a fluid
2 medium, the method including
providing a catalyst region within the microstructure;
4 providing a non-catalyst region within the microstructure; and
exposing at least part of the microstructure to the fluid medium, so that the catalyst region
6 and non-catalyst region are exposed to the fluid medium,
the fluid medium having a fluid component providing a chemical reaction catalyzed by
8 the catalyst region,
wherein the chemical reaction induces the relative motion between the microstructure and
10 the fluid medium.

24. The method of claim 23, wherein the relative motion is provided by an
2 interfacial tension gradient between the catalyst region and the non-catalyst region.

25. The method of claim 23, wherein the relative motion between the
2 microstructure and the fluid medium is a rotational motion, the catalyst regions being
disposed within radially outwardly extending portions of a substantially disk shaped
4 microstructure operating as a microgear.

26. The method of claim 23, wherein the microstructure is a component of a
2 microfluidic pump,
wherein the chemical reaction induces a flow of the fluid medium over the
4 microstructure.

27. The method of claim 23, wherein the relative motion is used to power the self-
2 powered autonomous directional motion of the microstructure through the fluid medium.

28. The method of claim 23, wherein the self-powered autonomous directional
2 motion of the microstructure is controlled by modifying a surface property of the non-
catalyst region.

29. A microstructure, the microstructure providing a motion relative to a fluid
2 medium when the microstructure is exposed to the fluid medium, the microstructure
comprising:

4 a catalyst region, the catalyst region catalyzing a chemical reaction of a fluid
component of the fluid medium;

6 a non-catalyst region, proximate to the catalyst region; and
a surface layer, supported by the non-catalyst region,

8 wherein the surface layer provides tunable surface wetting properties, the surface
wettability determining the direction of the motion relative to the fluid medium.

30. The microstructure of claim 29, wherein the surface wetting properties is
2 changeable by an external stimulus, so as to provide a modification of the motion relative
to a fluid medium.

31. The microstructure of claim 30, wherein the external stimulus includes
2 irradiation of the surface layer by electromagnetic radiation.

32. The microstructure of claim 30, wherein the modification is a reversal of the
2 motion relative to a fluid medium.

33. The microstructure of claim 30, wherein the external stimulus includes an
2 electronic potential.

34. The surface layer of claim 29, wherein the surface layer is a self assembled
2 monolayer.

2 35. The self assembled monolayer of claim 34, wherein the self assembled
monolayer is a (mercapto)hexadecanoic acid.

2 36. The microstructure of claim 29, wherein the surface wetting properties are
changeable by an interaction between the surface layer and an analyte within the fluid
medium, the interaction providing a modification of the motion relative to the fluid
4 medium, the modification allowing detection of the analyte.

2 37. The microstructure of claim 29, wherein the microstructure is a component of
a self-powered micromachine capable of an autonomous directional motion through the
fluid medium, the autonomous directional motion having a direction correlated with the
4 surface wetting properties.

2 38. The microstructure of claim 29, wherein the direction of the autonomous
directional motion is changeable through a controlled change in the surface wettability.

2 39. The microstructure of claim 29, wherein the microstructure is a component of
a sensor mechanism, the motion relative to the fluid medium providing a detectable force
on a force sensing mechanism, the detectable force being correlated with the surface
4 wettability.

2 40. The microstructure of claim 35, wherein the surface wettability is changed
through an interaction with an analyte within the fluid medium, a resulting change in the
detectable force being used to sense the analyte.

2 41. The microstructure of claim 29, wherein the microstructure is a component of
a microfluidic device, the motion being used to provide a fluid flow of the fluid medium
along a fluid pathway, the direction of the fluid flow being controllable by changing the
4 surface wettability.

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42. The microstructure of claim 29, wherein the catalyst region includes a metal.

43. The microstructure of claim 42, wherein the metal is platinum or palladium,
2 and the non-catalyst region includes a gold surface.

44. The microstructure of claim 29, wherein the catalyst region includes an
2 enzyme.